
Space Weather Technical Forecast

Issued on Monday, 29 November 2021 at 13:28 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales <https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales>

Space Weather Forecast Headline: No Significant Activity Expected.**Analysis of Space Weather Activity over past 24 hours**

Solar Activity: Solar activity was Very Low, with all X-ray flare activity below C-class. There are three active sunspot region on the Earth-facing disc. AR2898 (Cso/Beta) and AR2900 (Dso/Beta-Gamma) are both located in the southwest disc. AR2898 gradually simplified somewhat, with some fading in its trailing spots. AR2900 gradually increased in size, but also simplified a little in structure as some intermediate spots faded. The third region, AR2901 Hsx/alpha, in the northeast disc remained small and stable. There are a number of filaments on the disc and one was observed lifting from the southern hemisphere, just east of the Meridian at around 29/0745 UTC. It is possible that the CME associated with this may have an Earth directed component, but further analysis will be required once coronagraph imagery becomes available. No other Earth-directed CMEs were evident in available imagery.

Solar Wind / Geomagnetic Activity: The solar wind speed measured by DSCOVR at L1, was at ambient levels, varying between 335 and 395 km/s. Density was generally average (5-10 ppcc), but increased above average, up to 18 ppcc, between 28/1850 UTC and 29/0010 UTC. The Interplanetary Magnetic Field (IMF) strength, Bt, declined through the period from around 10-12nT to 4-6 nT. The north-south component of the field (Bz), was initially weakly positive, but gradually rotated to become largely weakly negative from 28/1830 UTC, with a notable period of around -6 nT observed 28/2130 UTC to 29/0300 UTC. The phi angle was generally negative (towards the Sun) throughout, but some brief transitions to positive were observed during the early part of the 29th. These parameters suggest the declining effects of the CME, possibly followed by connection to a weak coronal hole. Geomagnetic Activity was mainly Quiet to Unsettled (Kp 0-3), but an Active interval was observed 29/0000-0300 UTC.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) remained at background levels. High energy electron flux (greater than 2 MeV) as observed by GOES-16 was predominantly at background levels. The associated 24-hour integrated fluence remained below the Active threshold (1e8 integrated pfu), on a decreasing trend, with 2.49e6 integrated pfu recorded at 29/0000 UTC

Four-Day Space Weather Forecast Summary

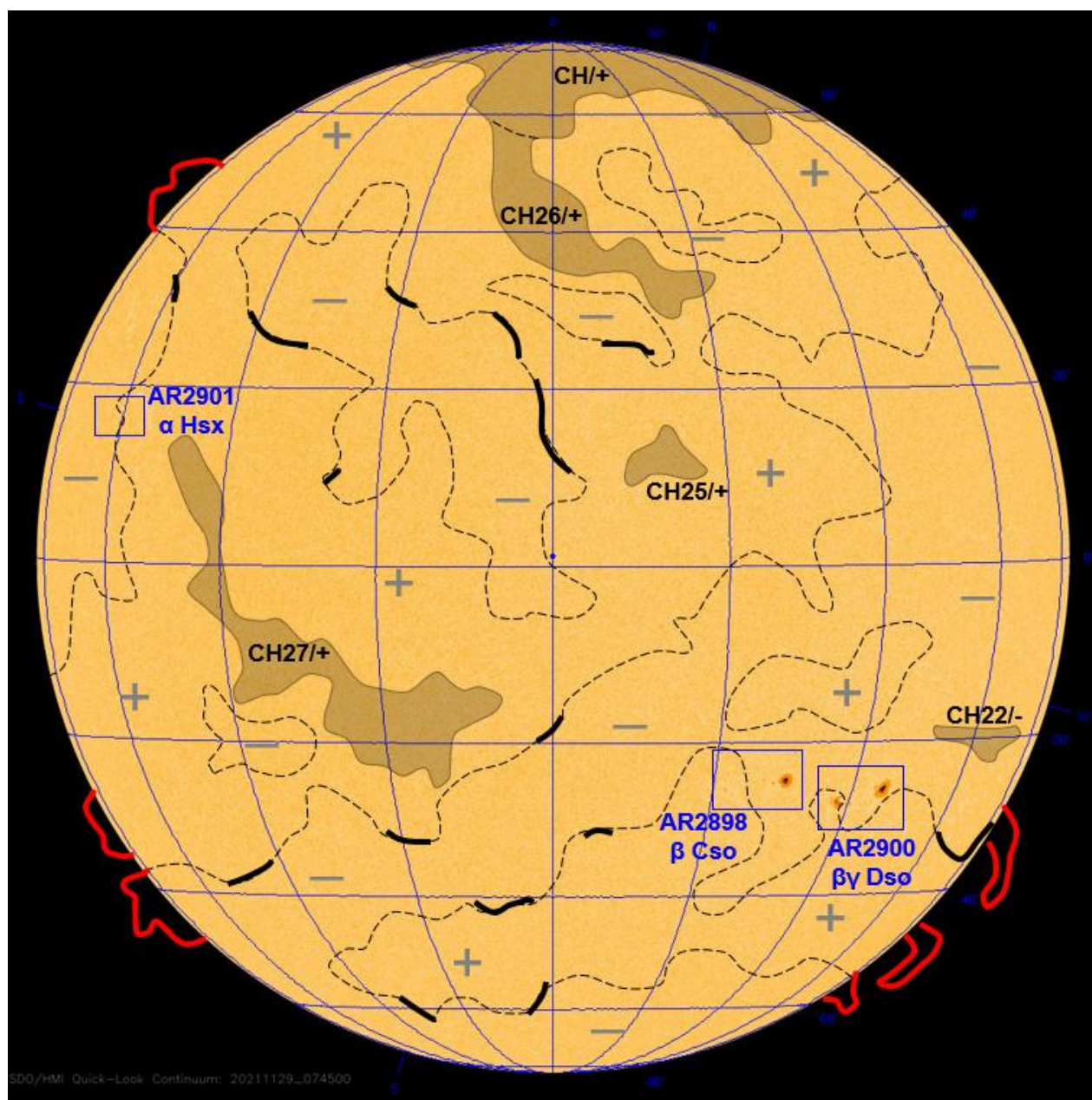
Solar Activity: Solar activity is likely remain predominantly Very Low, with a chance of C-class flares, primarily from AR2900. There is a very slightly above background (5%) chance of M-class flares.

Solar Wind / Geomagnetic Activity: A CME from a filament eruption early on the 26 Nov has been assessed as likely missing, but with low confidence, giving a small chance of some impact at Earth late day 1 or day 2 (29th or 30th). There may also be additional enhancements from various coronal holes fast winds through the period. This includes though from CH22 or CH24 at first, and then also from CH25 or CH26 on day 3 (1st). Enhancement from CH27 is also possible by the end of day 4 (2nd). Geomagnetic activity is expected to mostly Quiet with occasional Unsettled spells, but with an ongoing chance of Active intervals, and a very slight chance of G1/Minor Storms on all days.

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Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to remain at background levels. The high energy electron flux (greater than 2 MeV) is likely to be at background to moderate levels, with the next notable enhancement likely to be from the arrival of the fast winds from CH25 or CH26 on day 3 (1st). If this occurs, the fluence may rise as a result, but it is currently expected to remain below the Active (1e8 integrated pfu) threshold.

Figure 1. Solar Analysis Valid 29/0800 UTC.



Key: Filament —, Prominence —, Magnetic Field Line - - -, Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α - β - γ - δ and Zurich-McIntosh Axx etc.

Geomagnetic Storms:

A filament eruption was observed from the northeast disc around 26/0010 UTC, however analysis of any subsequent CME has been difficult due to limited good imagery. Whilst currently not expected, a glancing impact is possible, perhaps late day 1 (29th) or more likely day 2 (30th). There are no other Earth directed CMEs in the forecast.

The solar wind is at ambient levels, but Earth is likely experiencing the waning effects of either CH24/+ or CH22/-. Further coronal hole enhancements are then likely day 3 (1st), from either CH25/+ or CH26/+, with an enhancement in solar wind parameter observed on STEREO A during the later part of the 28th, corresponding to a likely day 3 arrival at Earth.

Finally, CH27/+, whilst located in the eastern hemisphere it appears to be a notable feature, and whilst its fast wind is not expected to arrive until day 5 (3rd), there is the potential for a very fast solar wind (near 700 km/s, which has been observed from some coronal holes in the southern disc during the last month) to arrive by the end of day 4 (2nd).

Consequently geomagnetic activity is expected to mostly Quiet, but with occasional Unsettled spells. There will be an ongoing chance of Active intervals on all days, due to the chance of coronal hole fast wind or CME arrivals, and a very slight chance of G1/Minor Storms.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	5	5	10	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

None expected.

Radio Blackouts - X-Ray Flares:

There are currently three active sunspot regions on the Earth-facing disc. AR2898 (Cso/Beta) and AR2900 (Dso/Beta-Gamma) are both located in the southwest disc. AR2898 has shown some signs of decay over the past 24 hours with fading in its trailing spots. AR2900 has seen some penumbra growth but some of the intermediary spots have decayed. Both have remained stable with no notable flaring during the past 24 hours. The third region, AR2901 (Hsx/alpha), in the northeast is a small but stable and mature feature, situated amongst a small area of plage. Solar activity is likely to remain Very Low, with a chance of C-class flares, most probably from region AR2900 in the southwest. There is an above background chance of M-flares (5%).

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	5	5	5	5
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as observed by GOES-16 is forecast to remain at background levels, with no solar radiation storms anticipated.

Radiation Storms	Level (cm ⁻² sr ⁻¹ s ⁻¹)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = cm⁻²sr⁻¹s⁻¹)

High Energy Electrons Event ($\geq 2\text{MeV}$):

The high energy (greater than 2 MeV) electron flux as observed by GOES-16 at GEO has mainly been at background levels during the last 24 hours, and is expected to be at background to moderate levels throughout much of the period. The next main enhancement is likely to be from the fast wind of CH25 or CH26, potentially increasing levels to High on day 4 (2nd), however confidence is low. Other enhancements to the solar wind on days 1-2 are currently not expected to lead to high flux levels being observed.

With flux remaining below the High level until at least day 4, the associated 24 hour integrated fluence is expected to remain below the Active threshold, with only a slight chance of rising above at the end of the period (2nd). This is supported by REFM which maintains fluence levels at well below the Active threshold.

GEO Electron Environment	Level ($\text{cm}^{-2} \text{sr}^{-1} \text{day}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^8$	No	1	1	1	10
Very Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^9$	No	1	1	1	1